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(54) [Title of the Invention] INPUT DEVICE

(57) [Abstract]
[Object] An input device used in the data input of a numerical controller or the like, that is capable of flexible operation, and enables accurate data input without making a display screen dirty.
[Constitution]
On the display regions A-T of the display screen 27a, input data, and information to be input prior to operation of, for example, a numerical controller, such as parameters, pitch error correction amounts, and tool correction amounts, are displayed. When an operator using his finger 40 lightly presses, for example, touch region g of the touch panel 28, as shown in FIG. 1, the corresponding display region G is displayed in a color different from that of the other regions—for example, if the other regions are white, then region G is displayed in a color such as blue. When the operator wishes to select the input data of display region G, he presses firmly on the touch region g, causing the display region G to turn, for example, red.

[Claims]
Claim 1
An input device for inputting data, comprising:

a touch panel comprising a touch section having a plurality of touch regions in a matrix shape, a first input mechanism for detecting input when a touch region has been subject to pressure within a certain range, a second input mechanism for detecting input when a touch region has been subject to pressure greater than said certain range;

input data display means for displaying input data for selection using the touch panel on the display regions on a screen of a display device;

highlight display means for—when the first input mechanism has detected input at the touch region—making highlighted display of the display region corresponding to the touch region at which input was made; and

input data determination means for—when the second input mechanism has detected input at the touch region—determining the input data on the screen corresponding to the region at which input was made to be the input data.

Claim 2
The input device of claim 1, wherein the first input mechanism comprises a first touch switch of a conductive film type in which contact points are provided in correspondence with the touch regions and first touch detection means for detecting when the contact points of the first touch switch have made contact, and the second input mechanism comprises a push switch comprising a plurality of mechanical switches provided in correspondence to the contact points of the first touch switch means and push detection means for detecting input when the contact points of the mechanical switches have come in contact.

Claim 3
The input device of claim 1, wherein the first input mechanism comprises a second touch switch of a conductive film type in which contact points are provided in correspondence with the touch regions and second touch detection means for detecting input when contact points of the second touch switches have come in contact, and the second input mechanism comprises a third touch switch of a conductive film type in which the contact points are provided in correspondence with the contact points of the second touch switch and third touch detection means for detecting input in a case where contact points of the third touch switch come in contact.

Claim 4
The input device of claim 1, wherein the first input mechanism and the second input mechanism share a resistance type touch switch comprising a resistant thin film the resistance value of which changes with pressure sandwiched between conductive films; the first input mechanism has first resistance type touch detection means for detecting input when the resistance value between contact points of the resistance type touch

switch is within a prescribed resistance value; and the second input mechanism has second resistance type touch detection means for detecting input when the resistance value between contact points of the resistance type touch switch is outside the prescribed resistance value.

Brief Explanation of the Invention
[0001]
[Industrial Applicability]
The present invention relates to an input device for inputting data; more specifically, it relates to an input device used for data input for a numerical controller and the like.

[0002]
[Background Technology]
Conventionally, the predominant method for making data input for a numerical controller or the like was to use a keyboard or key switch. However, because with keyboards and key switches, each key is capable of inputting only a set number or character, they were incapable of flexible operation.

[0003]
Thus, the input device called a "touch panel" has come into use. This device comprises touch switches in a matrix shape on the display screen of a cathode ray tube or the like. There are a number of types of touch panels, including resistance film type, electrostatic capacity type, infrared type and ultrasound type.

[0004]
[Problems the Invention Aims to Solve]
However, resistance film type and electrostatic capacity type had the problem of decreased transparency, because a thin film was laid across the display screen. Moreover, because these touch screens required that hands directly touch the display screen to make input, there was the drawback that screens easily became dirty. In particular, when used with numerical controllers and the like, there was the problem of even greater dirtiness, because of oil and dust and the like.

[0005]
Further, with infrared types and ultrasound types, there was the danger that simply from direct sunlight on the display screen or insects or drops of water etc. adhering to the display screen switches would be turned on. The present invention was conceived in light of these points, and its object is to provide an input device that is capable of flexible operations and is capable of accurate data input without the dirtying of the display screen.

[0006]
[Means for Solving the Problems]
To solve the above problems, the present invention provides an input device for inputting data, comprising: a touch panel comprising a touch section having a plurality of touch regions in a matrix shape, a first input mechanism for detecting input when a touch region has been subject to pressure within a certain range, and a second input mechanism for

detecting input when a touch region has been subject to pressure greater than said certain range; input data display means for displaying input data for selection using the touch panel on the display regions on a screen of a display device; highlighted display means for—when the first input mechanism has detected input at the touch region—making highlighted display of the display region corresponding to the touch region at which input was made; and input data determination means for—when the second input mechanism has detected input at the touch region—determining the input data on the screen corresponding to the region at which input was made.

[0007]
[Operations]
When an operator pushes a touch region of a touch panel with pressure within a certain range, the first input mechanism detects this, and the display region of the display device corresponding to the touch region at which input was made undergoes highlighted display. Thus it is immediately apparent to which position on the screen the touch region pressed by the operator corresponds.

[0008]
Moreover, when the operator presses a touch region of the touch panel with pressure greater than a certain range, the second input mechanism detects this, and the input data corresponding to the touch region at which input was made is determined to be the data for input.

[0009]
[Embodiments]
A first embodiment of the present invention will be explained with reference to the drawings. FIG. 2 is a hardware block diagram of a numerical controller comprising an input device according to the present invention. A processor 21 controls the overall numerical controller in accordance with a system program installed in the ROM 22. For the ROM 22, EPROM or EEPROM is used. For a RAM 23, DRAM or the like is used, and various types of data or input signals are stored therein. For a non-volatile memory 24, a battery-backed up CMOS is used, and parameters, pitch error correction amounts, tool correction amounts and other information that is to be maintained even after power is cut is stored therein.

[0010]
An operating panel 25 comprises a graphic control circuit 26, a display device 27, a touch panel 28 and a keyboard 29. The graphic control circuit 26 converts digital signals into display signals and sends the same to the display device 27. A cathode ray tube or LCD device is used for the display device 27, and axial position display, input/output signal status, parameters etc. are displayed thereupon. The display device 27 displays input data etc. for input using the touch panel 28.

[0011]
The touch panel 28 is an input device capable of flexible operation in accordance with the display content of the display device 27; it is used in the selection of a selection menu etc.

to be displayed on the screen and in data input and the operation of a work machine 31. Data input or work machine 31 operation difficult to operate using the touch panel 28 is carried out using the keyboard 29.

[0012]
A PMC (programmable machine controller) 30 receives output signals via a bus 32, processes these output signals with a sequence program and controls the work machine 31. The PMC 31 also receives input signals from the machine, performs sequence program processing thereupon, and forwards the input signals to the processor 21 via the bus 32.

[0013]
The foregoing constitutional elements are linked to each other by the bus 32. FIG. 3 is a conceptual diagram of the display device 27 and the touch panel 28. The touch panel 28 comprises a touch section 28a. This touch section 28a is divided into 20 individual touch regions a-t. A display screen 27a of the display device 27 comprises display regions A-T corresponding to the touch regions a-t of the touch panel 28. On the display regions A-T, input data for selection using the touch panel 28 is displayed as needed. The touch panel 28 enables flexible selection of input data displayed on the display regions A-T. More specifically, when any of the touch regions a-t is pressed, and input data of any of the display regions A-T corresponding thereto is determined to be the data for input.

[0014]
FIG. 4 is a cross-sectional view along the X-X line of FIG. 3. In this drawing, the cross-sectional construction of touch regions f through j is shown. The entire surface of the touch section 28a is covered with a protective film 281. Beneath the protective film 281, a touch switch 287 is provided. This touch switch 287 comprises conductive film groups 282, 283 and a spacer 284. The conductive film group 282 comprises four band-shaped conductive films 282a to 282d provided respectively along each of touch regions groups a-e, f-j, k-o and p-t.

[0015]
The conductive film group 283 comprises five band-shaped conductive films 283a-283e provided respectively along each of touch regions groups a-p, b-q, c-r, d-s and e-t. A spacer 284 is provided between the conductive film groups 282 and 283. The spacer 284 is an insulating body that is a molded single sheet of thin film, and holes 284a-284t are provided therein at locations corresponding to each of touch regions a-t respectively. The conductive film groups 282 and 283 are normally separated from each by the spacer 284, but when there is light pressure from the protective film 281 direction, they come in contact with each other through the holes 284a-284t.

[0016]
Below the touch switch 287, a push switch 288 is provided. The push switch 288 comprises a touch terminal group 285 and a contact point group 286. The touch terminal group 285 comprises touch terminals 285a-285t provided in each of the portions corresponding to touch regions a-t respectively. Each of the touch terminals 285a-285t is

attached so that one end thereof is in contact with the respective band-shaped conductive film 283a-283e or is disposed nearby. Each of the touch terminals 285a-285t can move vertically due to a spring not shown in the drawings. For this reason, each of the touch terminals 285a-285t will move downwards upon pressure from the direction of the band-shaped conductive films 283a-283e.

[0017]
The contact point group 286 comprises contact points 286a-286t provided at the other ends of the touch terminals 285a-285t. When any of the touch terminals 285a-285t has been subject to pressure of at least a certain level from the direction of the band-shaped conductive films 283a-283e, the respective contact point 286a-286t makes contact. The terminals of the contact points 286a-286t on the touch terminals 285a-285t side are connected to each of touch regions a-p, b-q, c-r, d-s and e-t, and the terminals on the other end are connected to each of touch regions a-e, f-j, k-o and p-t.

[0018]
In FIG. 4, of these constitutional elements, only the band-shaped conductive film 282b, holes 284f-284j, touch terminals 285f-285j and contact points 286f-286j are shown.

[0019]
FIG. 5 is a drawing showing the overall configuration of the switch mechanism of the touch panel 28. Connected to the touch panel 28 are a touch switch circuit 287a and a push switch circuit 288a. The touch switch circuit 287a is connected to each band-shaped conductive film 285a-285e [sic] and 286a-286e [sic]. The touch switch circuit 287a constantly monitors the ON/OFF condition of the touch regions a-t using a matrix method, and when it detects that any of these has been turned on, it sends the detection signal to the processor 21 via the bus 32.

[0020]
The push switch circuit 288a is connected to the contact points 286a-286t of the push switch 288. The push switch circuit 288a constantly monitors the ON/OFF condition of the contact points 286a-286t using a matrix method, and when it detects that any of these has been turned on, it sends the detection signal to the processor 21 via the bus 32.

[0021]
FIGS. 1 and 6 are drawings for explaining the method of operation of the touch panel 28 having the above constitution. First, on the display regions A-T of the display screen 27a, input data, and information to be input prior to operation of, for example, a numerical controller, such as parameters, pitch error correction amounts, and tool correction amounts, are displayed. Further, NC program commands and figures and the like are displayed. When an operator using his finger 40 lightly presses, for example, touch region g of the touch panel 28, as shown in FIG. 1, the corresponding display region G is displayed in a color different from that of the other regions—for example, if the other regions are white, then region G is displayed in a color such as blue.

[0022]

When the operator wishes to select the input data of display region G, he presses firmly on the touch region g, causing the display region G to turn, for example, red. Determination is made that this is the input data for input, and this data is processed at the processor 21. If the data that the operator wishes to input is not the input data of display region G but the data of, for example, display region H, the operator moves his finger 40 in the direction of the display region H, with his finger 40 remaining in contact with the touch section 28a. As shown in FIG. 6, together with the movement of the finger, the blue display portion also moves. By pushing firmly with his finger 40 when the blue display portion reaches the display region H, the operator causes the display region 40 to turn red. The corresponding data is determined to be the input data, and this data is processed at the processor 21.

[0023]
Thus, in the present embodiment, when the touch section 28a of the touch panel 28 has been lightly touched, the corresponding display region on the display screen 27a is display highlighted, for example, in blue, and when it is pushed more firmly, the corresponding data is determined to be the input data; thus the data that can be input using the touch section 28a is not fixed, as with a keyboard, and flexible operation is enabled.

[0024]
Further, because the finger 40 does not directly touch the display screen 27a, the screen does not become dirty. Therefore, there is consistently good image display. Further, because a switch mechanism can be constituted without using an infrared type or an ultrasound type, there is no danger of a switch turning on simply because of exposure to direct sunlight or the adherence of an insect or drop of water or the like. Thus accurate data entry is possible.

[0025]
In the present embodiment, the switch mechanism of the touch panel 28 is constituted with a touch switch 287 and a push switch 288, but the present invention is not limited to such a constitution, and a constitution where two touch switches are stacked is possible. In such a case, if the spacer of the lower touch switch is thicker than the spacer of the upper, a light touch will not cause the conductive films 282, 283 to come in contact, so a two-stage switch mechanism as in the above embodiment is possible.

[0026]
Further, a resistance film may be inserted into the holes 284a-284t of the spacer 284. A resistance film is a substance the resistance value of which changes depending on external pressure, so with a constitution where change in resistance value between the conductive films 282 and 283 in any of the regions a-t is detected, a two-stage switch mechanism is possible using only the touch switch 287.

[0027]

Further, in the present embodiment, a touch switch 287 constituted by conductive films 282, 283 and spacer 284 was used; alternatively, an electrostatic capacity switch using a glass substrate in place of the conductive films 282, 283 may be used.

[0028]
In the present embodiment, the touch panel 28 was used in a numerical controller, but it may also be used in a programmable controller, robot control device, automatic shooting and the like, and may be used in a general input device.

[0029]
Further, in the present embodiment, the touch panel 28 had 12 [sic] regions a-t, but the present invention is not limited thereto, and any number of regions may be provided to the extent physically possible.

[0030]
[Effect of the Invention] According to the present invention as explained above, when a touch region of a touch panel is lightly pressed, the corresponding display region on the screen of a display device is displayed highlighted, and when the touch region is pressed more firmly, the corresponding data is determined to be the input data; therefore the data that can be input using the touch panel is not fixed, as in a keyboard, and flexible operation is enabled.

[0031]
Further, because the screen of the display device is not directly touched, the screen does not become dirty. Therefore there is consistently good image display. Further, because a switch mechanism can be constituted without using infrared or ultrasound switches, there is no danger of the switch turning on because of exposure to direct sunlight or adherence of an insect or drop of water. Therefore, accurate data entry is enabled.

Brief Description of the Drawings

FIG. 1 is a drawing for explaining a method of operating a touch panel.
FIG. 2 is a hardware block diagram of a numerical controller comprising an input device of the present invention.
FIG. 3 is a conceptual drawing of a display device and touch panel.
FIG. 4 is a cross-sectional view along the X-X line of FIG. 3.
FIG. 5 is a drawing showing the overall constitution of a switch mechanism of a touch panel.
FIG. 6 is a drawing for explaining method of operating a touch panel.

Explanation of the Legends
21: processor
25: operating panel
26: graphic control circuit
27: display device
27a: display screen

28: touch panel
28a: touch section
281: protective film
282: conductive film group
283: conductive film group
284: spacer
287: touch switch
288: push switch
[in figures]

[FIG. 5]
287a: touch switch circuit to bus 32
288a: push switch circuit 288a to bus 32